Lab 1 - Cloud Computing

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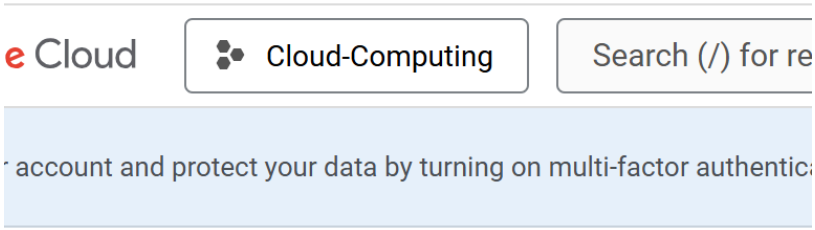
GitHub Link: https://github.com/okikio-school/cloud-computing-labs/tree/main/Lab%201
Video Links:

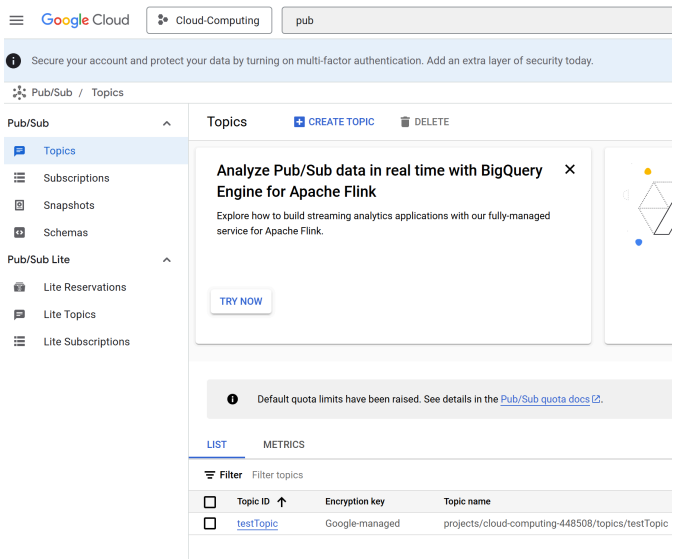
- **Smart Meter Video**: SmartMeter - Screen Recording 2025-01-23 011927.mp4
- **Design Part Video**: Design Part - Screen Recording 2025-01-23 020435.mp4

Activity

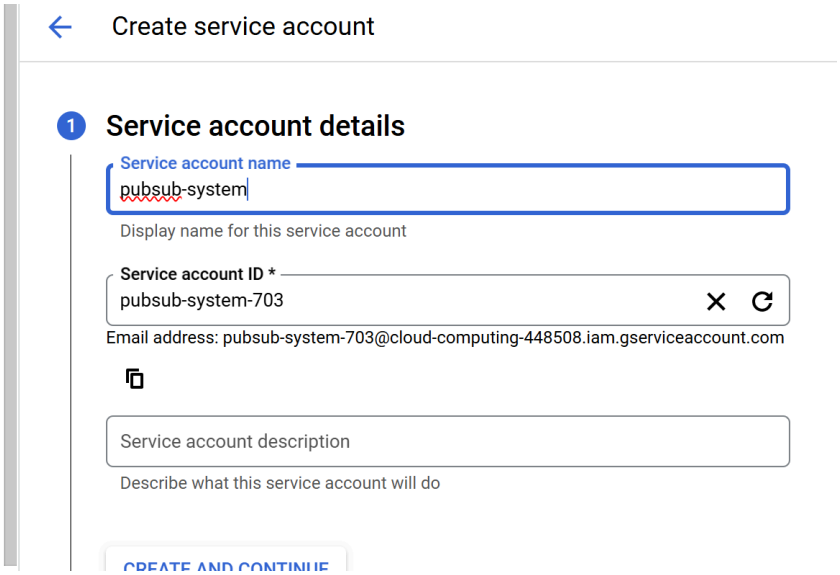
Step 1. Create GCP Project



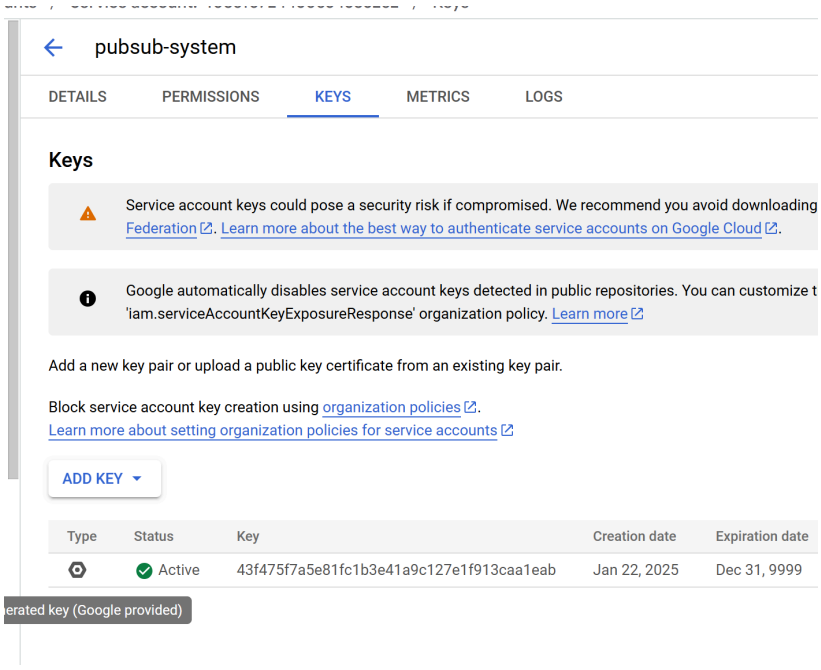
Step 2. Create Pub/Sub called testTopic



Step 3. Create Service Account called pubsub-system



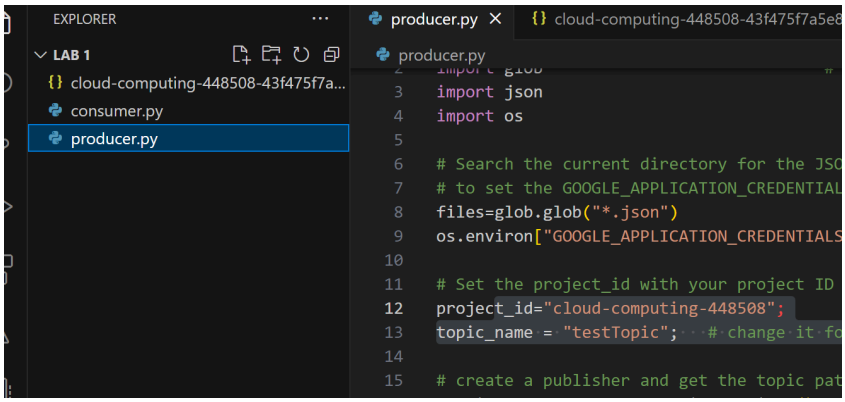
Step 4. Create Keys for pubsub-system



Step 5. Configure the Project ID from the Cloud Project ID

```
# Search the current directory for the JSON file (including the servi
# to set the GOOGLE_APPLICATION_CREDENTIALS environment variable.
files=glob.glob("*.json")
os.environ["GOOGLE_APPLICATION_CREDENTIALS"]=files[0];

# Set the project_id with your project ID
project_id="cloud-computing-448508";
topic_name = "testTopic";   # change it for your topic name if needed

# create a publisher and get the topic path for the publisher
publisher = pubsub_v1.PublisherClient()
topic_path = publisher.topic_path(project_id, topic_name)
print(f"Published messages with ordering keys to {topic_path}.")
```

Step 6. Downloaded service account keys as JSON



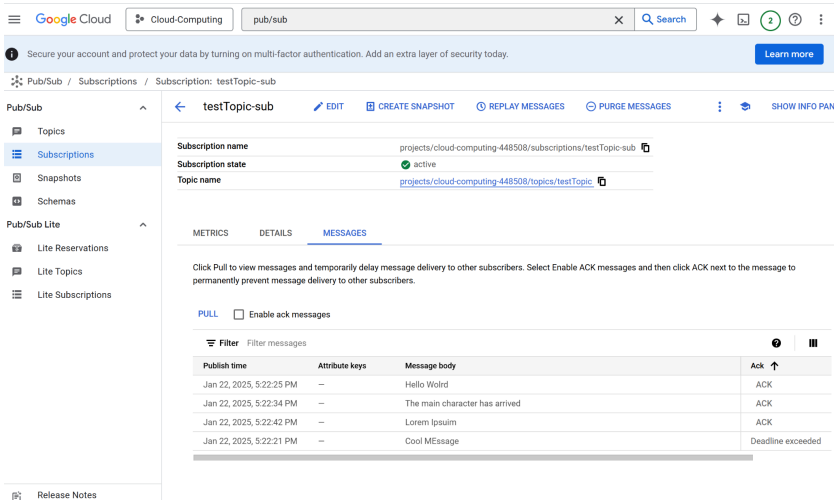
Step 7. Install the python google-cloud-pubsub library into Anaconda

```
(base) C:\Users\femik>pip install google-cloud-pubsub
Collecting google-cloud-pubsub
  Downloading google_cloud_pubsub-2.27.2-py2.py3-none-any.whl.metadata (9.7 kB
Collecting grpcio<2.0dev,>=1.51.3 (from google-cloud-pubsub)
  Downloading grpcio-1.69.0-cp312-cp312-win_amd64.whl.metadata (4.0 kB)
Collecting google-auth<3.0.0dev,>=2.14.1 (from google-cloud-pubsub)
  Downloading google_auth-2.37.0-py2.py3-none-any.whl.metadata (4.8 kB)
Collecting google-api-core!=2.0.*,!=2.1.*,!=2.10.*,!=2.2.*,!=2.3.*,!=2.4.*,!=2
.*,!=2.6.*,!=2.7.*,!=2.8.*,!=2.9.*,<3.0.0dev,>=1.34.0 (from google-api-core[gr
]!=2.0.*,!=2.1.*,!=2.10.*,!=2.2.*,!=2.3.*,!=2.4.*,!=2.5.*,!=2.6.*,!=2.7.*,!=2.
*,!=2.9.*,<3.0.0dev,>=1.34.0->google-cloud-pubsub)
  Downloading google_api_core-2.24.0-py3-none-any.whl.metadata (3.0 kB)
Collecting proto-plus<2.0.0dev,>=1.22.0 (from google-cloud-pubsub)
  Downloading proto_plus-1.25.0-py3-none-any.whl.metadata (2.2 kB)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4
```

Step 8. Run the producer.py file and enter messages to produce to the pub/sub

```
(base) C:\Users\femik>cd C:\Users\femik\OneDrive - Ontario Tech University\Year
4\Cloud Computing\Lab 1

(base) C:\Users\femik\OneDrive - Ontario Tech University\Year 4\Cloud Computing\
Lab 1>python producer.py
Published messages with ordering keys to projects/cloud-computing-448508/topics/
testTopic.
Enter a value (String):Cool MEssage
Producing a record: b'Cool MEssage '
Enter a value (String):Hello Wolrd
Producing a record: b'Hello Wolrd'
Enter a value (String):The main character has arrived
Producing a record: b'The main character has arrived'
Enter a value (String):Lorem Ipsuim
Producing a record: b'Lorem Ipsuim'
Enter a value (String):
```

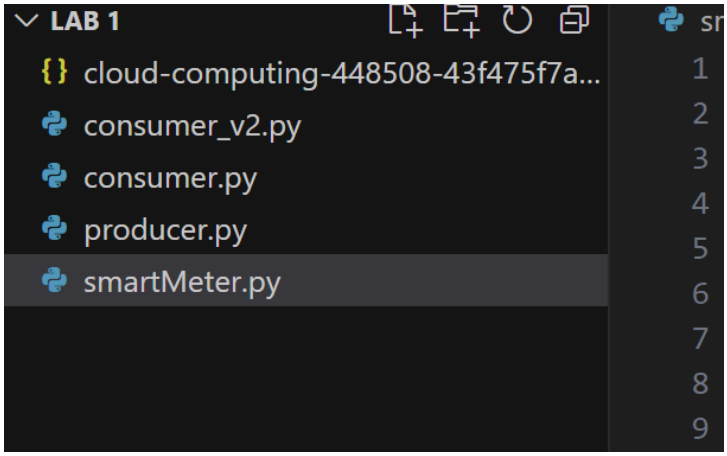
Step 9. Pull the messages for viewing



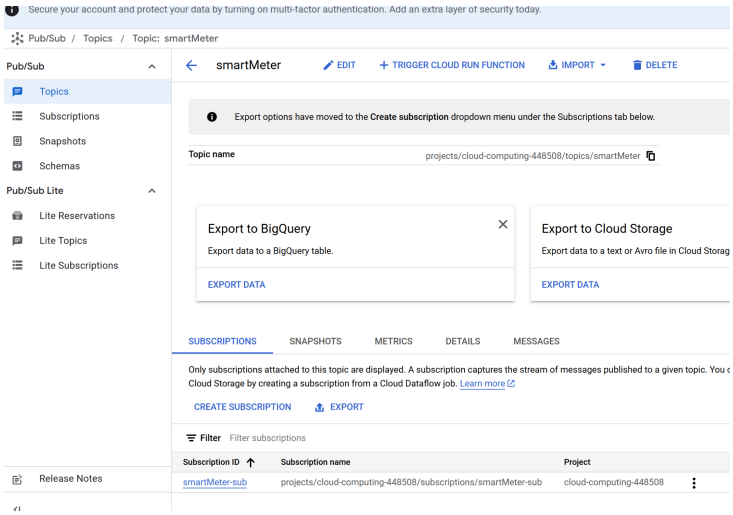
Step 10. Running the consumer.py file to pull messages from the pub/sub

```
(base) C:\Users\femik>cd C:\Users\femik\OneDrive - Ontario Tech University\Year
4\Cloud Computing\Lab 1

(base) C:\Users\femik\OneDrive - Ontario Tech University\Year 4\Cloud Computing\
Lab 1>python consumer.py
Listening for messages on projects/cloud-computing-448508/subscriptions/testTopi
c-sub..

Consumed record with value : b'Cool MEssage '
Consumed record with value : b'Lorem Ipsuim'
Consumed record with value : b'The main character has arrived'
Consumed record with value : b'Hello Wolrd'
```

Step 11. Copy smartMeter.py & consumer_v2.py (I later placed both smartMeter & consumer into the **./v2** directory so the github code isn't a 1-to-1 match)



Step 12. Create the Smart Meter Topic



Discussion

Question 1: What is EDA? What are its advantages and disadvantages?

EDA = Event Driven Architecture; it's a design pattern that is primarily driven by events, such that the architecture supports completely isolated and independent event producers and consumers, allowing each to independently act in response to an event and/or to send an event.

- **Pros**:
  - Scalable
  - Performant
  - Loose coupling

    - Highly flexible
    - Supports Parallel Processing
    - Supports Asynchronous Message Passing
    - Fault tolerant/Resilient
    - Supports Real-time processing
- **Cons**:
    - Adds Complexity
    - Event Ordering & Consistency can be issues
    - Dependent on the Event Broker as single points of failure

Question 2: Cloud Pub/Sub has two types of subscriptions: push and pull. Describe them, showing the strengths and weaknesses of each based on potential applications.

- **Push Subscriptions**:
    - Have the Pub/Sub topic continuously push messages when they are ready.
    - The only issue is if the subscriber doesn't acknowledge the event the Pub/Sub topic will have to continuously retry while trying to push the event to the subscriber, if after a number of retry attempts the subscriber doesn't acknowledge the event it gets discarded.
    - **Strengths**:
        - Low latency & great for Real-time processing e.g. great for real-time analytics
        - No need for manually polling on the subscriber; can have simpler clients, e.g. great for serverless functions
        - Simpler subscriber implementation as it just uses HTTPs endpoints to push the events to the subscriber e.g. since it's a simple HTTP endpoint they work really well for webhooks
    - **Weakness**:
        - Subscribers have less control over the event throughput, so lots of events from the Pub/Sub topic can easily overwhelm the subscriber; requires rate limiting or queueing to be setup e.g. bad for large batch data processing

        - Requires high network reliability of the subscriber otherwise events that can't be delivered will be discarded by the Pub/Sub topic e.g. great for streaming video calls

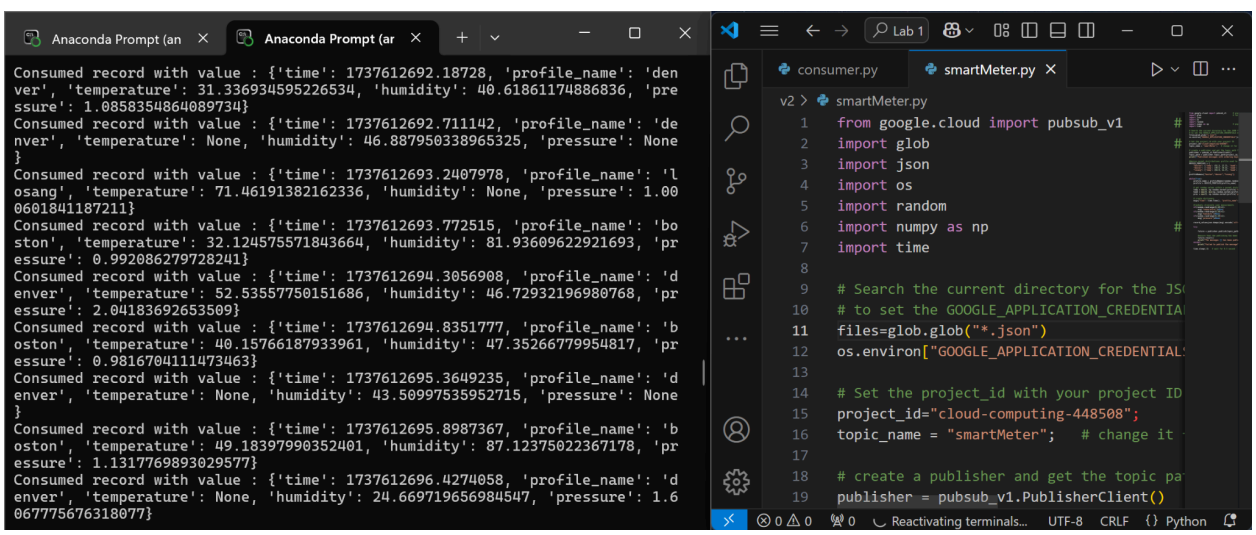
- **Pull Subscriptions:**
    - Let the Pub/Sub topic know when the subscriber is ready for messages
    - It requires the subscriber to be up and continuously polling to request new messages
    - **Strengths:**
        - Subscriber is fully in control over when events arrive, it's great for clients which can't handle being flooded with events, e.g. a small mobile devices with spotty network connectivity
        - Resilient to Temporary Network issues; since subscribers only pull once they are ready, so whether there is a temporary disconnection or not it likely won't affect the subscriber e.g. great for batch processing
    - **Weakness:**
        - More load on the subscriber to continuously check for new events; not great when there is a low amount of events e.g. bad for real-time tasks like analytics
        - Higher latency; since events only arrive after requesting them there is a potential slowdown e.g. bad for streaming video calls

Question 3: When publishing a message into a topic, an ordering key can be specified. Using examples, describe the role and benefits of ordering keys.

- Ordering keys are a feature to ensure events published with the same key are delivered to subscribers in the same order every single time
- They can assist Cloud Pub/Sub in identifying the priority order to choose when events arrive at the same time
- Due to parallel processing nature of Pub/Sub the order of events can get all twisted, ordering keys can assist in ensuring a strict event sequence is kept
- **E.g. Processing a checkout:**

    - A customer removes an item from their cart
    - Then finalizes their purchase
    - If the order is the opposite the customer will be very annoyed, ordering keys can always set it up such that all purchase events should be last after all other shopping events occur in time
- **E.g. Chat message:**
    - A customer sends a chat to a friend
    - If in that time the friend responds with their own message
    - If the order is wrong the chat history will be confusing
    - Using ordering keys you can ensure messages use the timestamp of the message and time it took the message sender to press and release the send button for determining which message should come first in the chat history

Smart Meter Screenshot:



Design Part Screenshot of Google Cloud (I forgot to record this as part of the video):

Google Cloud | Cloud-Computing | Search (/) for resources, docs, products, and more | Search

Pub/Sub / Topics / Topic: carDataTopic

Pub/Sub
- Topics
- Subscriptions
- Snapshots
- Schemas

Pub/Sub Lite
- Lite Reservations
- Lite Topics
- Lite Subscriptions

carDataTopic

EDIT | TRIGGER CLOUD RUN FUNCTION | IMPORT | DELETE

Export options have moved to the **Create subscription** dropdown menu under the Subscriptions tab below.

Topic name	projects/cloud-computing-448508/topics/carDataTopic

SUBSCRIPTIONS | SNAPSHOTS | METRICS | DETAILS | MESSAGES

Only subscriptions attached to this topic are displayed. A subscription captures the stream of messages published to a given topic. You car
Cloud Storage by creating a subscription from a Cloud Dataflow job. Learn more

CREATE SUBSCRIPTION | EXPORT

Filter | Filter subscriptions

Subscription ID	Subscription name	Project
carDataTopic-sub	projects/cloud-computing-448508/subscriptions/carDataTopic-sub	cloud-computing-448508